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Findings From Existing Data on the Department of Defense Industrial Base: Guided Missile and Space Vehicle Manufacturing Example

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Findings From Existing Data on the Department of Defense Industrial Base: Guided Missile and Space Vehicle Manufacturing Example

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Abstract

Seeking to monitor the defense supplier base over time, the Department of Defense has turned to periodic supplier surveys. Existing data may provide some of the same as well as trend insights faster, cheaper, and with less burden on suppliers. To demonstrate the potential of existing data to provide information on the defense supplier base, RAND researchers conducted some illustrative analyses using, among other sources, the System for Aware Management, the Federal Procurement Data System—Next Generation, and the Federal Funding Accountability and Transparency Act (FFATA) Subaward Reporting System (FSRS). Using these data can identify small-business participation in the supply base as well as the vulnerability of contractors and subcontractors to changes in their federal government prime contract and subcontract revenue. Such information can help policymakers better understand potential risks in the supply chain and better shape industrial-base policies.

Introduction

Better understanding its industrial base can help the Department of Defense (DoD) better leverage it and identify new and innovative suppliers within it (Gansler, 2011). As the DoD's budget shrinks, concern is rising regarding the effects of this shrinkage on key DoD suppliers over time, particularly those that are smaller subcontractors to prime contractors and on which the DoD has previously had limited or no visibility. Members of Congress and other policymakers have also been seeking ways to better monitor the defense supplier base (House Armed Services Committee [HASC] Panel on Business Challenges in the Defense Industry, 2012).

One way to gather information on the DoD's industrial base is to conduct surveys of prime contractors regarding their subcontractors. Such surveys are one time samples that can be costly and take time to field and assess. Given such time and expense, diminishing budgets, and a need to track changes over time, the DoD could benefit from alternative, faster, and cheaper ways to learn about the industrial base and continually monitor it from existing data.



This document is extracted from Moore, Grammich, and Mele (2014). It provides a Guided Missile and Space Vehicle Manufacturing industry example to illustrate how the DoD can gain information on its industrial base from data the federal government already collects. For additional analyses of contractors and weapons, please see the original document from which this document was extracted. We begin with background on sources of data relevant to the DoD industrial base and their availability. We then present some sample analyses of what these data can illustrate regarding the industrial base across the DoD as well as findings by an industry. We conclude with some overall observations and recommendations for future analyses.

Federal Sources of Data

The federal government has a number of systems that contain data on prime contractors and subcontractors. We discuss below five principal sources.

First, all businesses seeking prime contracts from the federal government must register in the System for Award Management (SAM), formerly the Central Contractor Registration (CCR). SAM/CCR registrants must provide their average annual revenue and number of employees for the past three years for their parent firm, which helps the government determine the size of the firm for small-business preference programs. Reporting revenue and employees for separately operating contractors of larger firms is optional, hence it is reported by some firms and not others. Firms also list industries as defined by North American Industry Classification System (NAICS) codes in which they claim to be capable of providing goods and services to the federal government, although they may also bid for contracts in other industries.

The SAM data includes the Data Universal Numbering System (DUNS) number for each contractor. DoD contractors also list their unique DoD-assigned and maintained Commercial and Government Entity (CAGE) codes. Federal contracting data use DUNS numbers for contract actions and subawards while DoD logistics systems use CAGE codes for contractors. If linkages are available, these codes can be used to link contractors to their parent firms as well as link SAM data to other data systems.

Second, the Federal Procurement Data System–Next Generation (FPDS-NG) contains contract actions for all federal purchases above the \$3,000, which is the micropurchase threshold. Contract action data contain the dollar value of the total award as well as the specific obligation for the action. Such data also have the contract number, NAICS code for the industry in which the goods or services are being provided, Product and Service Code (PSC, a more finely-grained indicator than the NAICS code) for the good or service provided, contractor DUNS number, contractor name, contractor socioeconomic status (including whether the contractor is a small business, and, if a small business, whether it is owned by disadvantaged individuals, women, or service-disabled veterans), contracting office placing the contract action, and place of performance where goods are made or services provided.

Third, the Federal Funding Accountability and Transparency Act (FFATA) Subaward Reporting System (FSRS) provides data on contract subawards.¹ Launched in July 2010,

¹ Other-than-small businesses are required to submit a Subcontracting Plan if the estimated award value of a federal contract exceeds \$650,000 (\$1.5 million for construction). All those required to



the FSRS has phased in requirements for reporting subawards (Federal Funding Accountability and Transparency Act Subaward Reporting System, n.d.). It initially required prime contracts with a total value of \$20 million or more to report such subawards by the end of the month in which they were made. The reporting threshold dropped to prime contracts valued at least \$550,000 in October 2010 and to those valued at least \$25,000 in March 2011. Contractors are not required to report first-tier subcontractor agreements, such as long-term arrangements for materials or supplies that would benefit multiple contracts and/or the costs of which are normally applied to a contractor's general and administrative expenses or indirect cost. Contractors with annual revenue of less than \$300,000 in the past year are exempt from subaward reporting requirements (Federal Acquisition Regulation [FAR] 52.204-10, 2015). For those subawards it reports, the FSRS data include the DUNS number of the subcontractor and the amount of the subcontract. It also includes the NAICS code associated with the subaward, which may be the NAICS code for the prime contract, the NAICS code for the subcontract, or the primary NAICS code for the subcontractor. Because contractors may register as many as 1,000 NAICS codes, their primary NAICS code may be unrelated to the NAICS code for the goods or services subcontracted.

Fourth, the U.S. Census Bureau collects data on businesses and their distribution within different industries (as defined by NAICS codes) over time. Its quinquennial Economic Census, conducted in years ending in "2" or "7," provides employee and revenue data for firms and establishments by their primary industry (U.S. Census Bureau, n.d.-a). Fully processing the results of the Economic Census can take two years or longer. The most recently available tabulations are for 2007. The 2012 tabulations are expected to be released in mid-2015. The Census Bureau also annually produces Statistics of U.S. Businesses (SUSB). These data contain, by industry, the number of firms, establishments, employees, and annual payroll (U.S. Census Bureau, n.d.-b). More dynamic SUSB data include that on firm births, deaths, expansions, and contractions.

Fifth, the U.S. Geological Survey (USGS) provides natural-hazard data for the contiguous United States on earthquakes, hurricanes, tornadoes, and floods by ZIP code (USGS, 2013). These data can be used to identify places of performance for DoD goods and services that may have significant supply risk.

DoD Sources of Data

The DoD has its own additional data sources on its purchases. We note five of these below.

First, the Federal Logistics Data on Portable Media, provided by the Defense Logistics Agency (DLA), provides information by National Stock Numbers (NSNs) on entity

submit subcontracting plans are required to submit one or more Individual Subcontract Reports and Summary Contract Reports on their subcontracts awarded to small businesses, including small businesses owned by socially and economically disadvantaged individuals, women, veterans, and service-disabled veterans, as well as those located in historically-underutilized business zones and having other characteristics of "HUBZone" businesses. Such plans are filed with the electronic Subcontracting Reporting System (eSRS). If the FSRS is providing the same data elements reported in the eSRS as well as additional information, it may be possible to replace eSRS reporting once FSRS applies to all contracts with an award value exceeding \$650,000.



managing the NSN, part/reference number, supplier, CAGE code, freight, interchangeability and substitutability, and other characteristics (DLA Logistics Information Service, 2013).

Second, the DLA's Enterprise Business System has an Active Contract File (DLA, 2013). This links NSNs to contract numbers, CAGE codes, and order quantities. The services have similar logistics data systems that link orders' NSNs to contracts.

Third the Army has a Contracting Business Intelligence System with data on the progress of contract actions, including what has been purchased. The Army's Logistics Modernization Program also has files that link NSNs to contract numbers and order quantities.

Fourth, the Air Force Materiel Command has a Strategic Sourcing Analysis Tool similar to the Army Contracting Business Intelligence System.

Fifth, the Navy is implementing a Logistics Information Technology Strategic Plan both ashore and for operational forces. Its long-term ashore plan is to establish a single solution for supply-chain management and to unify business processes and support activities. Its long-term plan for overseas forces is to deploy a single supply baseline accommodating all warfare communities, consolidating multiple commodity management, and reducing workload.

Ideally, the systems for each service will ultimately yield additional, readily-available data linking additional information on required materials to the DoD industrial base.

Data Availability and Quality Issues

At the time of our research, the public version of SAM provided firm information by CAGE code only, which is not used in the FPDS-NG or FSRS data, which uses DUNS numbers. This made it very challenging to link contractors to their parent firm. In addition, while prime contractors must register in the SAM, there is no requirement that government subcontractors do so. As a result, average annual revenue data may not be available for some subcontractors. In FY2014 the public version of SAM changed and now has DUNS numbers, but does not have average annual revenue and number of employees.

Not all of the data are readily available for public use. For security reasons, the public release of FPDS-NG prime contract-action data is delayed by 90 days. In addition, there is an administration time of about 60 days to update the data after the 90-day security delay has expired. Thus, there is about a 150-day delay in the public release of prime contract-action data after a contract action is taken.

The availability of subcontractor data is contingent on the award of new prime contracts for which subaward reporting is required. Multi-year contracts that were written before the subaward requirement need to be renewed with such a requirement before their subawards will be reported. Subaward data are also contingent on contractors actually reporting subawards. As we will discuss, some large contracts that very likely have subawards have no subawards reported.

The DLA requires a Memorandum of Understanding before it will release detailed Active Contract File data with details on all DLA contracts, including awards below the \$3,000 threshold for reporting to the FPDS-NG. The DLA memorandum includes a requirement that it review all analyses before they may be shared. Finally, the services must grant permission for accessing their sustainment data systems which can be used to link contractors and their contracts to specific weapon-system parts. Altogether, current federal and DoD data can offer several insights into the DoD industrial base. These are likely to



grow over time. Nevertheless, there are some limitations to these data now, some of which will be removed over time but others that are likely to remain.

The quality of the data and hence analyses based on it are dependent on the quality of input. Average annual revenue is dependent on contractor input, prime contract actions are dependent on contracting personnel input, and subawards are dependent on prime contractor input. As we discuss later, we identify data inconsistencies that need to be resolved and possible errors that need to be corrected. In addition, SAM and FPDS-NG data change over time as SAM data are updated and FPDS-NG data are corrected. Thus, the analyses that follow were based on the data at one point in time that may have subsequently changed or been corrected. As more people use these data to make policy decisions, the case will build to improve their quality. For example, automated validation and prompts for correction could eventually be implemented.

We turn next to some overall findings available in current data, including the share of DoD contract spending that is currently reportable to the FSRS.

Availability of Subaward Data

FSRS subaward reporting requirements are relatively new and were phased in from July 2010 to March 2011. Because contracts can span a number of years, the proportion of contracts that have the subaward reporting requirement increases over time. We discuss below the proportion of contracts that have FSRS information and what issues these raise for analyses of the industrial base.

The FSRS reporting threshold is based on the total award of the contract. As noted, an award, particularly a very large one, can span a number of years. The award amount (formerly total dollars obligated), and not the value of a specific contract action, determines whether a prime contract meets the FFATA reporting threshold. We call contracts that meet the reporting threshold reportable contracts.

The Award Amount field in the FPDS was not always completed. We therefore searched across recent contract actions to identify the contract award total value for these preliminary analyses. The DoD may need to place additional attention on ensuring that the total award value of contracts appears in the first contract actions and that the Award Amount field and any changes to it is populated on subsequent contract actions.

We analyzed FPDS data² from fiscal year (FY) 2010 through FY 2012 to identify percentages of contracts and contract dollars that were reportable to the FSRS over time. Table 1 presents the results of FY 2010 analyses. We found that, for contracts awarded (i.e., written) in FY 2010, less than 1% of contracts were subject to the reporting requirement, then \$20 million, but these accounted for more than 50% of awarded contract dollars.

² As discussed later, the data are not perfect. FPDS-NG and SAM.



Table 1. FSRS Data Coverage in FY 2010 FPDS-NG

FY 2010	DoD prime contracts signed between 6/1/2010 - 9/30/2010 FSRS reportable threshold > \$20M			
	total contracts	% reportable contracts	total \$s awarded M	% reportable \$s awarded
All, reportable	152,740	<1	42,642	51
All, reportable w subs	316	11	4,346	83
% with subs in FSRs	0.21	13	10	17

In FY2011, the reportable threshold shrank twice, first to \$550,000 starting October 1, 2010, and then to \$25,000 starting February 29, 2011. Table 2 presents the results of FY 2011 analyses. Coverage increased to over 98% of contract dollars awarded, but a little less than 24% of contracts were reportable.

Table 2. FSRS Data Coverage in FY 2011 FPDS-NG

FY 2011	DoD prime contracts signed in FY2011 FSRS reportable threshold > \$550K before 2/29/2011, > \$25K after			
	total contracts	% reportable contracts	total \$s awarded M	% reportable \$s awarded
All, reportable	386,456	23.83	311,530	98.32
All, reportable w subs	1,743	92.08	37,320	99.94
% with subs in FSRs	0.45	1.74	11.98	12.18

By FY 2012, when the reporting threshold was \$25,000 throughout the fiscal year, nearly 33% of contracts were subject to the reporting requirement, accounting for more than 99% of dollars, as shown in Table 3. These data also indicate that two thirds or 67% of all DoD contracts in FY 2012 were for amounts of less than \$25,000.

Table 3. FSRS Data Coverage in FY 2012 FPDS-NG

FY 2012	DoD prime contracts signed in FY2012 FSRS reportable threshold > \$25K			
	total contracts	% reportable contracts	total \$s awarded M	% reportable \$s awarded
All, reportable	351,299	33	254,588	99
All, reportable w subs	1,230	99	17,736	100
% with subs in FSRs	0.35	1	7	7

Thus, each year since implementation, FSRS data had higher proportions of contract award dollars from reportable contracts that may have subawards and subcontract dollars.

While virtually all contract dollars *awarded* in FY 2012 were reported to the FSRs, only 39% of contract dollars *obligated* for that year were as shown in Table 4. The remaining contract dollars (less the 1% of FY 2012 dollars *awarded* on contracts that were less than \$25,000 and exempt from FSRs reporting) were on older contracts not required to be reported to the FSRs. As these older contracts expire, the percentage of obligated contract dollars that are reportable to the FSRs will grow.



Table 4. Obligations on Older Multi-Year Contracts in FY 2012 FPDS-NG Limit Recent Reporting

FY2012	Awarded		Obligated	
	Total	Percent reportable	Total	Percent reportable
Contracts	351,299	33 ¹	475,336	30
Dollars M	\$254,588	99 ¹	\$360,865	39 ²

It was beyond the resources of this study to analyze the expiration dates of contracts with FY 2012 obligations that are above the minimum \$25,000 threshold and not reported to the FSRS. Such an analysis would show how fast the FSRS reporting requirement will cover most DoD obligations.

We identified all contracts awarded between FY 2010 and FY 2012 that were above the threshold for reporting to the FSRS. We grouped these into two categories for analysis: those with subawards reported and those without subawards reported. All prime contractors other than those with average annual revenue of less than \$300,000 are to report subawards to the FSRS. We found, however, no penalty in the FSRS legislation or on the FSRS web page for failure to report.

Table 5 shows the number of large contracts that were reportable to the FSRS but had not reported subaward data. Altogether, we found 321 contracts greater than \$100 million that were reportable to the FSRS without subaward data—including 38 worth more than \$1 billion awarded and 10 with more than \$10 billion awarded. We consider it unlikely that such contracts have no subawards.

Table 5. Many Large Reportable Contracts Have No Reported Subawards (FPDS-NG, FY 2010–FY 2012)

Number reportable contracts with no subaward data	Award value of contracts
10	> \$10 B
28	> \$1 B < \$10 B
41	> \$ 500 M < \$ 1 B
242	> \$ 100 M < \$ 500 M

Table 6. Top Reportable Weapon Contracts Without FSRS Data (FPDS-NG, FY 2010–FY 2012)

Top Reportable Weapon Contracts Without FSRS Data			
Awarded \$ M	Weapon system	Agency	Contractor
36,394	Air Force Tanker Rep	Air Force	THE BOEING CO
4,536	LCS	Navy	AUSTAL USA, LLC
3,294	CAA	MDA	BOEING CO
2,002	DD(X)	Navy	BATH IRON WORKS CORP
1,828	F-15	Air Force	BOEING CO, THE
1,340	DDG 51	Navy	BATH IRON WORKS CORP
1,131	EELV	Air Force	UNITED LAUNCH SERVICES, LLC
881	SSN 774	Navy	ELECTRIC BOAT CORP
798	SDB	Air Force	RAYTHEON CO
790	DDG 51	Navy	HUNTINGTON INGALLS INC
694	DDG 51	Navy	HUNTINGTON INGALLS INC
598	V22	Navy	ROLLS-ROYCE CORP
575	EELV	Air Force	UNITED LAUNCH SERVICES, LLC
559	CAA	MDA	RAYTHEON CO
535	JSF (F-35)	Navy	LOCKHEED MARTIN CORP
522	JSF (F-35)	Navy	LOCKHEED MARTIN CORP

Our analyses also identified several other data-quality issues that must be addressed for further analyses.

We found that contractor-reported average annual revenue for the past three years as reported in the CCR and the SAM was sometimes less than average total FPDS prime contract and FSRS subcontract revenue. This may be because the contractor is a new business or the reported revenue was in the wrong units. Another possible explanation would be the recent receipt of new contracts that are much greater than past contracts and have not yet been reported in revenue. Because average annual revenue may determine parent-firm size for small-business purposes, DoD should regularly check reported average annual revenue against actual revenue reported in the FPDS and FSRS and require immediate updating if large discrepancies are found.

The FPDS depends on input from contracting personnel for some data elements. Errors have been made on FPDS entries, which can take time to correct. That said, automated population of some FPDS elements from other data systems has helped improve the quality of FPDS data. Efforts have also been made to better train contracting personnel to improve input accuracy.

The FPDS has a data element called base plus all options for the total value of the contract. This data element is not always populated for the first or even second action on a contract and can change over time. Consequently, identifying reportable contracts over time was challenging given the lack of these data elements or population of these data elements with the amount of the initial and not ultimate award value of the contract.

The input of subaward data depends on input from prime contractors. While they are required to provide such data, there is no penalty for failing to do so. The requirement for

subaward data is also fairly new. Hence, prime contractors may not be proficient at entering correct dollar amounts or NAICS codes for the subaward.

In addition to assessing overall DoD subaward data, we next look at subaward data by contractor, weapon system, and industry.

In Table 7, we rank the 12 contractors with the largest number of reported subawards by the number of subawards associated with their prime contracts from FY 2010 to FY 2012. Ranking firms this way, as well as by their subaward dollars, helps identify firms to investigate for better understanding the DoD industrial base. Note that some company names are repeated. This is because some large companies comprise multiple contractors with multiple DUNS numbers. We found one contractor reporting more subaward dollars in the FSRs than prime-contract dollars in the FPDS: McCann World Group reported \$98 million in subawards made from prime contracts it received but the publically available FPDS contained prime-contract revenues of only \$16 million. Tracking down such anomalies was beyond our resources, but we can surmise some possible causes. Such error may arise from data-input problems or confusion of units. Another possible explanation is that public availability of FPDS data may be delayed for 90 to 150 days, while FSRs data are available as soon as posted. Thus, a contractor could have been issued a prime contract for which it reported subawards before the prime-contract data were publically available. We were hoping for more reported subawards, but realize that, at the time, a number of multi-year contracts were still in force that were not reportable.

Table 7. Contractors With the Most Reported FSRs Subawards (FPDS-NG, FY 2010–FY 2012)

Rank	Contractor	# Subaward	Subaward \$s M	Prime Award \$s M
1	DIETARY EQUIPMENT INC	378	4	6
2	SAIC (1)	278	23	39
3	TEXTRON INC.	255	40	549
4	ITT SYSTEMS CORP	249	119	902
5	LOCKHEED MARTIN CORP	218	502	1,083
6	FORCE 3, INC.	213	58	89
7	SAIC (2)	195	219	444
8	MCCANN WORLD GROUP INC	187	98	16
9	HENSEL PHELPS CONSTRUCTION CO	171	223	289
10	L-3 COMMUNICATIONS CORP	162	17	302
11	ATLANTIC DIVING SUPPLY, INC.	153	74	180
12	L-3 COMMUNICATIONS CORPORATION	150	43	226

Table 8 shows the 12 weapon systems with the largest number of reported subcontractors. It also shows the subaward dollars and the number of subcontracts for each. Again, we were disappointed not to see more subawards for weapons and are hoping this will also change with the passage of time.



Table 8. Weapon Systems With the Most Subcontractors (FPDS-NG, FY 2010–FY 2012)

Weapon System	# Subcontractors	Subaward \$s	# Subcontracts
PATRIOT	96	303,387,241	152
Trident II Missile	85	77,003,232	123
BMDS	60	157,017,630	70
E-2C Advanced Hawkeye	51	157,995,432	80
MLRS	32	196,196,978	66
LCS	28	27,326,443	34
CH-47F	26	27,864,684	104
Environmental Programs	19	6,667,205	25
CAA	17	9,114,647	27
APACHE (AH-64A)	17	14,702,716	125
V22	12	5,939,820	15
KIOWA WARRIOR	11	2,626,041	20

To illustrate what information FPDS and FSRS data could offer on industries, we first ranked industries, defined by their NAICS code, by their total reported subaward dollars. We then selected a specific industry for more detailed analysis, including concentration of the supply base.

Table 9 ranks industries by their total reported subaward dollars from FY 2010 to FY 2012. It also includes total reportable prime-award dollars and the number of different subcontractors that received subawards. Reportable prime-award dollars may be less than subaward dollars for some industries, as it is for two industries above, because the industry for the subaward may differ from that for the prime-contract award. For example, a large contract in aircraft manufacturing may have subcontracts in navigation systems. Understanding both would be key to understanding the industrial base for DoD aircraft.

One of the top 15 industries by subaward dollars, Guided Missile and Space Vehicle Manufacturing, ranked seventh with \$739 million in subawards and 225 subcontractors out of a total of 5,981 million in reportable prime contract awards. Because this industry is of interest for industrial-base issues, we selected it for our example of more detailed analysis.



Table 9. Industries With the Most Reported FSRs Dollars (FPDS-NG, FY 2010–FY 2012)

North American Industry Classification System (NAICS)	Dollars M		# sub-contractors
	Subaward	Prime awarded	
Commercial and Institutional Building Construction	7,692	27,599	1,690
Surgical Appliance and Supplies Manufacturing	2,607	279	14
Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)	1,290	18,621	799
Highway, Street, and Bridge Construction	816	1,308	17
Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing	772	9,254	152
Direct Health and Medical Insurance Carriers	755	45,874	10
Guided Missile and Space Vehicle Manufacturing	739	5,981	225
Computer Facilities Management Services	692	950	22
Other Ordnance and Accessories Manufacturing	481	1,531	19
Office Machinery Manufacturing	466	223	5
Engineering Services	389	10,294	327
Military Armored Vehicle, Tank, and Tank Component Manufacturing	257	3,258	187
Security Guards and Patrol Services	247	814	4
Aircraft Manufacturing	235	63,986	113
Computer Systems Design Services	180	3,841	123

Guided Missile and Space Vehicle Manufacturing Example

The DoD awarded 85 reportable prime contracts for Guided Missile and Space Vehicle Manufacturing from FY 2010 to FY 2012. These contracts, made with 31 contractors of 23 parent firms, had an aggregate value of \$5.98 billion. In FY 2012, the DoD obligated \$6.74 billion in subcontracts for this industry. The difference largely arises from newly awarded contracts and obligations made on contracts awarded before FSRs reporting requirements were in place.

Of the 225 subcontractors for Guided Missile and Space Vehicle Manufacturing, 221 were in the SAM. All of the subcontractors had subawards associated with DoD prime contracts. Twelve also had reported subawards for non-DoD prime federal contracts.

In addition, 164 of these subcontractors had their own prime federal contracts. Of these, 158 had DoD prime contracts, while 106 had non-DoD prime contracts (with some holding both DoD and non-DoD prime contracts).

For Guided Missile and Space Vehicle Manufacturing subcontractors registered in the SAM, we were able to determine small-business status. As shown in Table 10, more than half the subcontractors, or 57%, were small businesses. They received 63% of subcontracts and 49% of subcontracted dollars.



Table 10. Most Industry Subcontractors, But Not Dollars, Were Small Business (FPDS-NG, FY 2010–FY 2012)

SAM Classification	Subcontractors		subaward contracts		Subaward dollars	
	#	%	#	%	Amount	%
Small business	115	57	214	63	333,115,464	49
Other-than-small	86	43	128	37	346,564,434	51
Total in SAM	201 ¹	100	342	100	679,679,898	100

Comparing these data with Economic Census data can also yield information on how well the DoD is implementing small-business preference policies. In FY 2007, the DoD spent \$5.11 billion in Guided Missile and Space Vehicle Manufacturing, a total equivalent to one third of the \$15.3 billion in receipts the industry reported that year to the Economic Census. Of the DoD's prime-contract expenditures in that industry, 14.7% were with small businesses—exceeding the 6.0% of all revenues we estimate going to small businesses in that industry that year. The 49% share of DoD subcontracted dollars going to small businesses in this industry was greater still—and perhaps indicative of how the greatest opportunities for small business in this industry are in lower tiers of the supply chain.

Similarly, we were able to determine special status for small-business subcontractors providing goods and services in the Guided Missile and Space Vehicle Manufacturing industry, as shown in Table 11. Twenty-two percent of such subcontractors had special status; most of these were women-owned small businesses. Altogether, women-owned small businesses comprised 15% of small-business subcontractors in this industry, accounted for 17% of small-subcontractor contracts, and received 3% of revenues to small-business subcontractors in this industry. FSRS data can be used to learn more about small-business subcontracting plans within a specific industry.

Table 11. Many Industry Subcontractors Had Special Status (FPDS-NG, FY 2010–FY 2012)

Small Business Subcontractors	SB subcontractors		SB contracts		SB dollars	
	#	%	#	%	Amount	%
SDB, self identified	6	5	10	5	6,658,000	2
Woman Owned	17	15	37	17	10,739,303	3
Service Disabled Veteran Owned	2	2	4	2	5,800,723	2
Total	115	100	214	100	333,115,464	100

FSRS and FPDS data can offer information on supplier dependency. Leading purchasing textbooks (e.g., Burt, Petcavage, & Pinkerton, 2010) recommend that buyers purchase no more than 15% to 25% of any one supplier's entire capacity. This can guard against a buyer potentially putting a supplier out of business in the event of order cancellations due to economic downturn, product discontinuation, or switching to another supplier. This is particularly important for products with long lead times as the supplier may have significant resources invested in orders for inputs to production or work in progress. Others (e.g., Belavina & Girotra, 2010; Bitran, Gurumurthi, & Sam, 2006; Fung, Fung, & Wind, 2008; Gilliam, Taylor-Jones, & Costanza, 2005) note that consuming about 30% of a

supplier's capacity can help buyers command attention from suppliers while avoiding complete dependence of suppliers on a particular buyer's orders. Concerns of detrimental reliance and possibly even legal issues could ultimately arise if buyers account for more than 25% to 35% of a supplier's business (Ghamani, 2008; Paquette, 2004). (See also Moliné and Coves [2013], Federgruen and Yang [2011], and Agrawal and Nahmias [1997] on modeling supply bases and optimizing order allocation over multiple suppliers.)

To calculate supplier dependence on the DoD, we calculate the sum of reported FPDS prime contract and FSRS subcontract revenue as a percentage of average total revenue as reported in SAM. Because, as we will see, smaller contractors have greater dependence on the federal government, we present separately results for those with average annual revenue less than or greater than \$100 million.

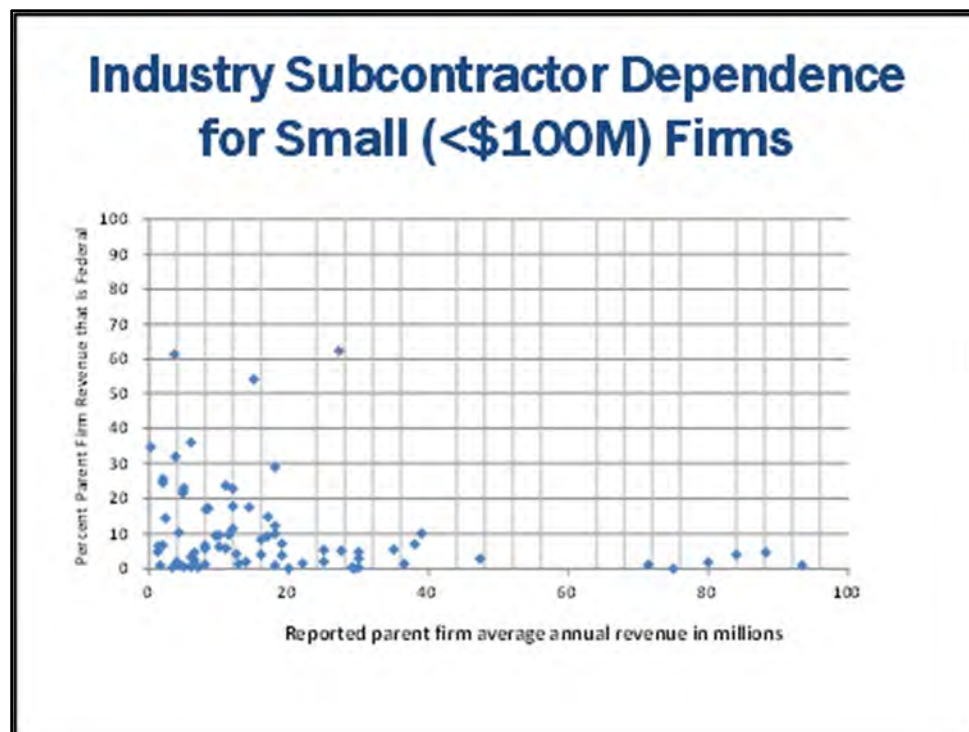


Figure 1. Industry Subcontractor Dependence for Small (<\$100 Million) Firms (FPDS-NG, FY 2010–FY 2012)

Figure 1 shows, for subcontractors in Guided Missile and Space Vehicle Manufacturing whose average annual revenue is less than \$100 million, the percentage of the parent firm revenue that is federal (vertical axis) and the total reported parent firm average annual revenue (horizontal axis). We derive our federal revenue calculations, as previously noted, from the FPDS prime contract awards and FSRS subcontract awards and our parent firm average annual revenue from that reported to the SAM.

Two of these small firms received more than 60% of their reported revenues from the federal government, and a third received more than 50% of its revenue from the federal government. Most firms received less than 20% of their revenue from the federal government—indicating that the supply base in this industry is not greatly dependent on the DoD or the federal government overall. Nevertheless, we caution this analysis is only illustrative. In FY 2012, about 60% of obligated dollars, as noted earlier, were not reported to FSRS, even though 99% of new awards were. Including these other purchases over time,

as should happen as more contracts become subject to FSRS, may show a different level of supplier dependency.

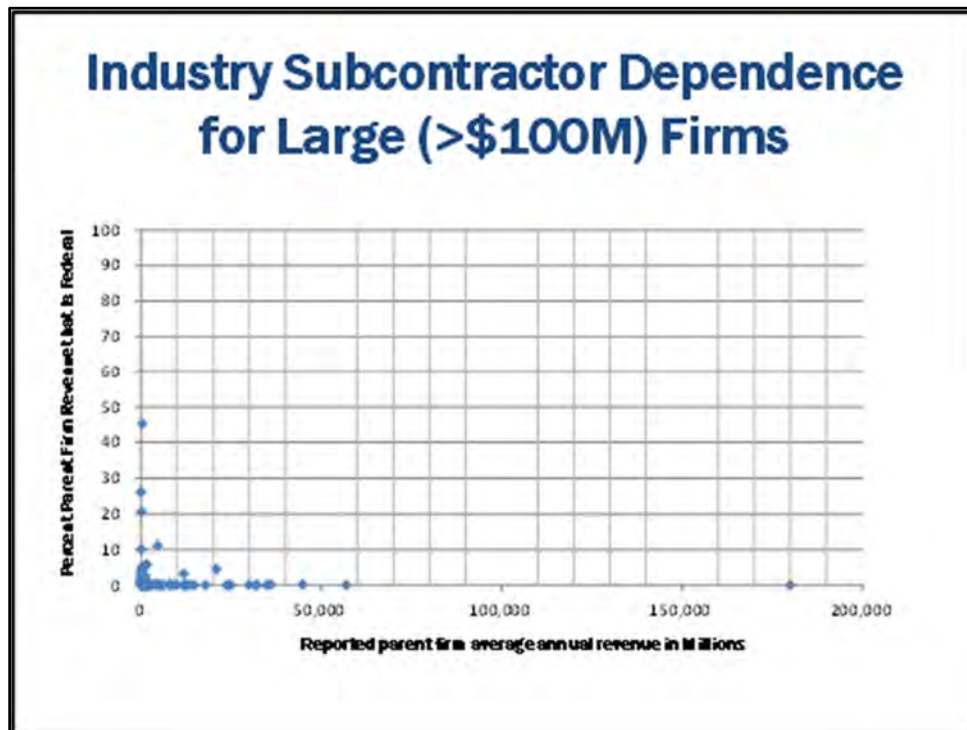


Figure 2. Industry Subcontractor Dependence for Large (>\$100 Million) Firms (FPDS-NG, FY 2010–FY 2012)

In Figure 2, we show federal-government dependency for subcontractors in Guided Missile and Space Vehicle Manufacturing whose average annual revenue is more than \$100 million. Not surprisingly, few such large firms have much dependence on the federal government. For only two firms did we find dependence on federal revenue exceeding 25%, and for only five firms did we find it as high as 10%. All such firms had less than \$1 billion in average annual revenue. Of course, these numbers could change as more obligated dollars are subject to reporting in the FSRS.

Table 12. Subcontractors With > 25% Revenue From Federal Prime and Subawards (FPDS-NG, FY 2010–FY 2012)

Subcontractor	Average revenue for past three years				
	Parent	FPDS	FSRS	Total federal	% federal
TOYON RESEARCH CORP.	27,181,515	16,810,387	106,499	16,916,886	62
AMC INCORPORATED	3,621,438	2,183,500	36,410	2,219,910	61
REAL-TIME LABORATORIES, LLC	15,000,000	2,054,115	6,014,928	8,069,042	54
DLT SOLUTIONS, LLC	511,000,000	229,098,387	1,843,828	230,942,216	45
YORK INDUSTRIES, INC.	6,000,000	1,887,882	266,818	2,154,700	36
R&B DESIGNS	250,000	40,027	46,345	86,372	35
INVOCON, INC.	3,800,000	1,192,562	16,667	1,209,229	32
TELEDYNE REYNOLDS, INC.	18,000,000	5,037,340	156,522	5,193,863	29
AIRBORNE SYSTEMS NORTH AMERICA OF CA INC	151,645,000	31,808,353	7,669,891	39,478,245	26
ADVANCE METALWORKING COMPANY, THE	2,000,000	491,760	18,829	510,589	26

We ranked individual subcontractors in Guided Missile and Space Vehicle Manufacturing by their calculated dependence on federal revenue. Table 12 contains the top 10 subcontractors at risk with more than 25% of their average parent revenue derived from federal-government contracts. We list their average parent, FPDS prime contract, FSRS subcontract, and total federal revenue for the past three years, as well as the federal percentage of all revenues. Note that all of these subcontractors have both prime-contract and reported subcontract revenue from the federal government. Exploring the particular goods and services these subcontractors provide could better identify what level of risk supplier failure could pose by linking them to key DoD requirements such as critical parts for its top weapons.

Table 13. Subcontractors With Federal Revenue Exceeding Total Revenue (FPDS-NG, FY 2010–FY 2012)

Subcontractor	Average revenue for past three years				
	Parent	FPDS	FSRS	Total federal	% federal
HARRIS CORPORATION	1	-62,086	6,544,269	6,482,183	648218342
TELEDYNE STORM PRODUCTS, INC.	1	112,972	303,752	416,724	41672393
STEVE LIEBER & ASSOCIATES INC	1	14,203	119,980	134,183	13418340
PRESIDIO COMPONENTS INC.	1	29,102	23,335	52,437	5243730
HAIGH-FARR INC.	10	92,191	353,296	445,486	4454863
B.J.G. ELECTRONICS, INC.	100	1,458,198	678,873	2,137,071	2137071
MICROPHASE CORPORATION	100	331,367	38,322	369,689	369689
AEROJET-GENERAL CORPORATION	662,967	4,785,668	10,068,716	14,854,384	2241
RAYTHEON COMPANY	200,000,000	318,555,945	27,561,182	346,117,127	173
EMF, INC.	6,500,000	555,384	7,950,941	8,506,325	131

For 10 subcontractors in Guided Missile and Space Vehicle Manufacturing, we calculate that federal revenues exceed 100% of reported total average revenues. (These subcontractors are excluded from the preceding scatterplots.) We list these above, as well as their average parent-firm revenue, their average FPDS prime contract³ and FSRS subcontract revenues in the past three years, their average total federal revenues (sum of FPDS and FSRS revenues), and the percentage that total federal revenues comprise of their average revenue for the past three years. For example, Harris Corporation reported to the SAM that it received only \$1 in total revenue (an anomaly we discuss below). At the same time, it had an average annual FPDS prime contract revenues of -\$62,086 (likely from deobligations on prime contracts), and average annual subcontract revenues from the FSRS of \$6,544,269. Together, these account for average total federal revenues of \$6,482,183, or more precisely, \$6,482,183.42. This yields an obviously anomalous result of 648,218,342% of revenue that is federal for Harris, the result of dividing \$6,482,183.42 in federal revenues by \$1 in total revenues.

We surmise several possible causes for federal revenues exceeding reported total revenues. The first seven subcontractors listed above all reported average annual revenues of less than \$100, with most reporting average annual revenues of only \$1. These may be new firms receiving their first federal contracts, and hence unsure what to report for total firm revenues in the SAM, although it might be unusual for new firms to receive million-dollar contracts.

The eighth subcontractor on the list, Aerojet-General Corporation, is a large contractor with more than one DUNS number. Another DUNS number for it on the

³ Deobligations may result in a firm having negative FPDS revenue, as is evident for one subcontractor listed above.

subcontractor list has parent revenue of \$662,967,000, or 1,000 times larger than the total revenue listed for Aerojet above. We surmise this is a case of income being entered in the wrong units for this DUNS number.

The ninth contractor on the list, Raytheon Company, may have reported local revenue and not parent revenue.

Summary Findings and Recommendations

Our analyses demonstrate that SAM, FPDS, and FSRS data can help in gaining visibility of the DoD's Tier 1 and Tier 2 suppliers. Knowing this information can be obtained from existing data, even though these data sources can be improved in some ways, may negate the need to conduct expensive and time-consuming surveys of these firms.

Our analyses also found many DoD suppliers have both prime contracts and subcontracts that cross weapon systems, goods, and services. The extent to which they depend on federal and DoD spending is critical to understanding their ability to withstand significant budget decreases.

We also found that FSRS subaward data are still being populated, particularly as new awards subject to subcontract reporting are made. As contracts expire and requirements to report subawards expand to more obligated dollars, the FSRS data will eventually cover the vast majority of Tier 2 subcontractors. Indeed, our analysis showed increasing proportions of contracts and dollars being reported to the FSRS. Furthermore, if the DoD needs to obtain information on Tier 3 subcontractors, it can use the FSRS data to do a smaller, more focused survey of Tier 2 subcontractors as needed.

Beyond increasing and improving coverage of the FSRS over time, our analyses found some issues with the SAM that should be addressed for the benefit of any future analyses. In particular, we identified what appear to be erroneous entries for average annual firm income. These problems can be corrected easily by requiring firms to frequently update their average annual revenue whenever they receive a federal prime contract or associated subcontract and periodically checking to see if the SAM data are consistent with FPDS and FSRS data.

The last subcontractor on the list, EMF Inc., may have recently received one or more new contracts that bumped its average federal revenue above its reported average annual revenue. The SAM data for all these firms need to be checked and revised to ensure total revenue includes all federal prime contract and subcontract revenue plus all other revenue.

Our analyses point to four recommendations for improving the use of existing data to analyze the DoD industrial base.

First, we recommend that the DoD encourage and verify that prime contractors with reportable contracts report their subawards. Reporting is required by law and typically by contract as well. Our analyses indicated several examples where this may not be happening. Contracting officers may need to ensure that subawards are indeed reported. We also recommend that the DoD encourage contractors with multi-year contracts that are not reportable to report their subawards to the FSRS, possibly in lieu of the requirement to report special small-business status of their subcontractors and their subawards to the eSRS.

Second, we recommend the DoD work to improve the quality of prime contractor and subcontractor data. It can do so in several ways. It can require contractors and subcontractors to frequently update their average annual revenue in the SAM and then verify they have done so. It can also require all subcontractors with subawards greater than



\$25,000 to register in SAM, and require that prime contractors report the industry (NAICS code) for the subaward, not that for the prime contract.

Third, we recommend that the DoD consider surveying Tier 2 subcontractors on their Tier 3 subcontractors—although only after the FSRS is better populated or has better coverage of all subawards, not just those on recently awarded contracts subject to FSRS reporting. More generally, while analyzing FSRS and other existing data systems can provide many insights the DoD needs to optimize its operations and supply chains, supplemental surveys focusing on data elements not currently collected can help provide a still broader picture of DoD suppliers. In addition, surveying suppliers about their immediate suppliers, particularly at lower tiers, may be needed, given the reluctance, or possibly even inability, of suppliers' suppliers to divulge information about still lower-tier suppliers.

Fourth and finally, we recommend that analyses be expanded with other data, such as that on supplier financial risks and natural disasters for supplier place of performance, as well as that for key weapon-system parts. Such existing data, if properly improved and combined, already gathered for other purposes, can perhaps provide the DoD greater information on its industrial base, including those over time, than any new and expensive surveys would, and without further burdening suppliers.

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